

## **Zeta Potential at the Metal Oxide-Aqueous Solution Interface at Temperatures up to 200 °C**

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Numerous research groups are currently working on the problems associated with isoelectric points (IEPs) and zeta potentials (ZPs) of a number of environmentally significant metal oxide-aqueous solution systems under ambient temperature and pressure conditions. However, almost no data exist for these critical parameters at elevated temperatures and pressures prevalent throughout most of the crust. Understanding mineral surface and adsorption behavior above 25°C is necessary to model transport of dissolved species in deep groundwater and from nuclear repository facilities. A high temperature zetameter based on the microelectrophoresis technique was developed to determine ZPs and IEPs of the metal oxide-aqueous solution interfaces at temperatures up to 200°C and pressures up to 50 bar [1]. Design of the microelectrophoresis cell, the main unit of the zetameter, utilized a flow-through concept and the cell internals are made from corrosion resistant materials in order to minimize materials degradation and solution contamination. The experimental data have been obtained for ZrO<sub>2</sub>-, TiO<sub>2</sub>-, and Al<sub>2</sub>O<sub>3</sub>-aqueous solution interfaces over wide ranges of pH and temperature up to 200°C. Water and 0.001 mol/kg NaCl(aq) solution were tested at these temperatures. The desired pH values were made adding either HCl(aq) or NaOH(aq). The IEPs of the ZrO<sub>2</sub>-aqueous solution interface at 25, 120 and 200°C were found equal to 6.05, 5.00, and 4.67, respectively. For the TiO<sub>2</sub>-aqueous solution interface the IEPs were 5.26 at 25°C, 5.13 at 120°C, and 4.50 at 200°C. It was found that the IEP values for the Al<sub>2</sub>O<sub>3</sub>-aqueous solution interface were 8.70 at 25°C, 6.04 at 120°C, and 5.67 at 200°C. Therefore, we have confirmed that the IEPs of the metal oxides are sensitive to temperature and the difference between the IEP and 0.5pK<sub>w</sub> remains constant at temperatures up to 200°C for the ZrO<sub>2</sub>- and TiO<sub>2</sub>-aqueous solution interfaces.

[1] X.Y. Zhou, X. J. Wei, M.V. Fedkin, K.H. Strass, and S.N. Lvov, (2002), A zetameter for microelectrophoresis studies of the oxide/water interface at temperatures up to 200°C, Rev. Sci. Instru. 2003 (in press).